

PATENT ABSTRACTS OF JAPAN

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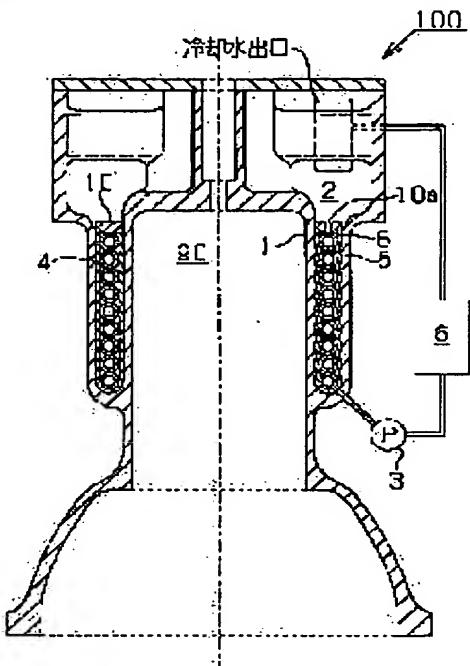
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(54) CYLINDER BLOCK PROVIDED WITH COOLING WATER JACKET

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a cylinder block provided with a cooling water jacket capable of eliminating a process for removing a filler of a cavity part.

SOLUTION: In the cylinder block provided with the cooling water jacket molded by insert casting an insert member, a hollow reinforcing member is inserted into the inserting member to be insert molded. The reinforcing member is formed of a pipe having a communicating hole. A plate member having the communicating hole is molded into a pipe shape, and thereby, the reinforcing member is molded. The plate member is spirally molded, so that the reinforcing member is formed. The reinforcing member is formed with a single member of a hollow shape.



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CLAIMS

[Claim(s)]

[Claim 1] The cylinder block equipped with the cooling water jacket characterized by having interpolated the reinforcement member in the air, and cast-wrapping and fabricating it to said insertion member in the cylinder block equipped with the cooling water jacket fabricated by cast-wrapping an insertion member.
[Claim 2] The cylinder block equipped with the cooling water jacket according to claim 1 which formed said reinforcement member in the pipe which has a free passage hole.

[Claim 3] The cylinder block equipped with the cooling water jacket according to claim 1 or 2 which fabricated the reinforcement member by fabricating the plate member which has a free passage hole in the shape of a pipe.

[Claim 4] The cylinder block equipped with the cooling water jacket according to claim 1 which formed the reinforcement member by fabricating a plate member spirally.

[Claim 5] The cylinder block equipped with the cooling water jacket according to claim 1 with which a reinforcement member consists of a single member of a hollow configuration.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the internal combustion engine which equipped the cylinder block with the cooling water jacket.

[0002]

[Description of the Prior Art] The path (cooling water jacket) of the cooling water in an internal combustion engine's cylinder block is made from the former with the metal mold of aluminum dies casting. The mold equivalent to a cooling water jacket is made from aluminum dies casting, and the cavernous section for putting water into this mold beforehand is made and cast. However, only by it, since the cavernous section was crushed by the casting pressure force, sand and a shot ball were put in the cavernous section as a cure, and these padding had been extracted after casting. However, reinforcement may become an ununiformity, if considerable cautions are required and restoration becomes inadequate, in order to fully fill up the cavernous section with padding, such as sand.

[0003]

[Problem(s) to be Solved by the Invention] This invention aims at offering the cylinder block equipped with the cooling water jacket which can skip the process which removes padding of the cavernous section in view of the above-mentioned situation.

[0004]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, in the cylinder block equipped with the cooling water jacket fabricated by cast-wrapping an insertion member, to said insertion member, the reinforcement member in the air was interpolated, and was cast-wrapped and fabricated in invention of claim 1. In invention of claim 2, said reinforcement member was formed in invention of claim 1 in the pipe which has a free passage hole. In invention of claim 3, the reinforcement member was fabricated in invention of claim 3 by fabricating the plate member which has a free passage hole in the shape of a pipe. In invention of claim 4, the reinforcement member was formed by fabricating a plate member spirally in invention of claim 2. In invention of claim 2, the reinforcement member was fabricated in invention of claim 5 by the single member of a hollow configuration.

[0005]

[Embodiment of the Invention] Drawing 1 is the vertical section transverse-plane schematic drawing of the cylinder block 100 of the internal combustion engine common to invention of claim 1 - claim 5. In drawing 1, the cooling water jackets 5 which interpolated the insertion member 4 which mentions the perimeter of a cylinder block 1 later in detail are surrounding the cylinder block 100.

[0006] In the cylinder block 100 after casting, cooling water is supplied to a cooling water jacket 5 with a pump 3 from the lower part, cooling water absorbs the heat of a cylinder block 1, while passing through between the inside of the insertion member 4 in a cooling water jacket 5, or the insertion member 4 and the cooling water jackets 5, through the cylinder head section 2, it is sent to a radiator 6 from the outflow of cooling water from the upper part of a cooling water jacket 5, and is cooled from it, and cooling water is again supplied into a cooling water jacket 5 with a pump 3.

[0007] (Claim 1, example of invention of two) Drawing 2 is the top view of the insertion member 4 by which interpolation is carried out to the cylinder block 100 (drawing 1) by invention of claim 1 and claim 2. Moreover, drawing 3 is the III-III sectional view of drawing 2.

[0008] As shown in drawing 2 and drawing 3, the insertion member 4 equips the perimeter with the circular sulcus 7 of an owner bottom, and the interior has become a cavity. Into the circular sulcus 7 of the insertion member 4, more than one are accumulated until the annular reinforcement member 8 results [from pars-

basilaris-ossis-occipitalis 7a (drawing 3) of a circular sulcus 7] in opening 7b (drawing 3) in the hollow which is a circular sulcus 7 and this heart, and has rigidity by the size which can be exactly contained to a circular sulcus 7. The reinforcement member 8 is formed by incurvating annularly the pipe material which has centrum 8a (drawing 3). After interpolating the reinforcement member 8 in a circular sulcus 7, fitting of the annular lid 10 shown in drawing 3 is carried out to opening 7b of a circular sulcus 7.

[0009] Left-hand side [alternate long and short dash line / of drawing 1] shows the virtual configuration of a cylinder block 100 where the insertion member 4 in a cooling water jacket 5 is not crushed after casting. Right-hand side [alternate long and short dash line / of drawing 1] shows the actual configuration of the cylinder block 100 after casting. The sufficient room is secured to letting cooling water pass in a cooling water jacket 5 although the cooling water jacket 5 is crushing a little the part into which the interval of the reinforcement member 8 which adjoins with the insertion member 4 became depressed. On the lid 10 made [the upper part of the insertion member 4] to carry out fitting, hole 10a for pouring the water of a complement beforehand is prepared in the need part at two or more places (only one of them is displayed on drawing 1), and cooling water flows to the cylinder head section 2 through the hole 10a.

[0010] In the periphery of a cylinder block 1, mold shaping is carried out bordering on the appearance of the above-mentioned insertion member 4, the cooling water jacket 5 of drawing 1 can do some irregularity, as the pressure at the time of casting shows a cooling water jacket 5 to the right-hand side of drawing 1 , but if it collects cooling water in a cooling water jacket 5, it can be made to be able to pass and it can cool a cylinder block 1.

[0011] The reinforcement member 8 is made to open for free passage each centrum 8a (drawing 3) of the reinforcement member 8 which forms two or more holes 9 and adjoins, as shown in drawing 2 here, and the cooling water supplied with the pump 3 of drawing 1 passes through the inside of the hole 9 (drawing 2 R> 2) of the reinforcement member 8 in the insertion member 4, and centrum 8a (drawing 3), and can flow to the cylinder head section 2. the insertion member 4 -- for example, processing of aluminum etc. -- it can form with an easy metal and the pipe made from steel can be used for the reinforcement member 8.

[0012] (Example of invention of claim 3) An example of the manufacture approach of the reinforcement member 8 is explained. Drawing 4 (a) is the front view of the plate 11 which is the raw material of the reinforcement member 8. Two or more hole 11a is prepared in the long and slender plate 11 shown in drawing 4 (a) in two trains at the longitudinal direction of a plate 11.

[0013] As an arrow head A shows, this plate 11 is incurvated so that **** 11b and 11c may counter, and the pipe 12 as shown in drawing 4 (b) is formed. As an arrow head B shows further, a pipe 12 is annularly incurvated so that the edges 12a and 12b of a pipe 12 may counter, and the reinforcement member 8 in the air is formed by annular, as shown in drawing 4 (c).

[0014] Drawing 5 (a) is the front view of the plate 13 which is another raw material of the reinforcement member 8. Alternate arrangement of the hole 14 is carried out at the plate 13 shown in drawing 5 (a). The mesh pipe 15 which this plate 13 is incurvated as an arrow head C shows like the plate 12 of drawing 4 R> 4 (a), and is shown in drawing 5 (b) is formed. As furthermore shown in drawing 5 (c), the mesh pipe 15 is annularly incurvated, as an arrow head D shows, and the reinforcement member 8 is formed.

[0015] Drawing 6 (a) is the front view of the plate 16 which is still more nearly another raw material of the reinforcement member 8. The square hole 17 is arranged regularly in all directions at the plate 16 of drawing 6 (a). The pipe 18 which this plate 16 is incurvated as an arrow head E shows, and is shown in drawing 6 R> 6 (b) is formed, it is made to curve annularly after that and the reinforcement member 8 (not shown) is formed.

[0016] Drawing 11 is the top view showing the condition of having inserted in the circular sulcus 7 of the insertion member 4 the pipe 12, the mesh pipe 15, and pipe 18 which are shown by drawing 4 (b), drawing 5 (b), and drawing 6 (b) with the straight-line configuration. In this case, the time and effort which incurvates pipe 12 grade can be saved, and simplification of a routing can be attained.

[0017] (Example of invention of claim 4) Drawing 7 (a) is the front view of the plate 19 whose example of invention of above-mentioned claim 3 is a raw material for forming the reinforcement member 8 by the option. A plate 19 is spirally incurvated along a cylindrical side face, and the spiral member 20 as shown in drawing 7 (b) is formed. The reinforcement member 8 (not shown) is formed by incurvating this spiral member 20 annularly. As shown in drawing 11 mentioned above, you may insert into the insertion member 4 in the condition with the shape of a straight line, without incurvating the spiral member 20 of drawing 7 (b).

[0018] (Example of invention of claim 5) Drawing 8 is the expansion perspective view of the reinforcement member 21 by invention of claim 5. some cooling water jackets 5 in the condition that, as for drawing 9 R>

9, interpolation of the reinforcement member 21 was carried out into the cooling water jacket 5 -- it is drawing of longitudinal section.

[0019] Although the insertion member 4 is the same structure as the insertion member 4 mentioned above, the reinforcement member 21 differs from the reinforcement member 8 in each above-mentioned example at the point which has integral construction until it results [from pars-basilaris-ossis-occipitalis 7a of the circular sulcus 7 (drawing 1) of the insertion member 4] in opening 7b.

[0020] In order to make easy to understand structure of the annular reinforcement member 21 interpolated in the cooling water jacket 5 in drawing 9 , in drawing 8 R>8, the annular reinforcement member 21 was opened and shown in the plane. In drawing 8 , the reinforcement member 21 bent the plate of one sheet by two places, prepared [both ends] the stage for one side in the shape of a key in the joint 22 in piles, and has received the other-end section. As shown in drawing 9 , the irregularity of a joint can be stored in the centrum 23 of the reinforcement member 21, and it becomes easy to insert the reinforcement member 21 into the insertion member 4 by carrying out the method of junction like a joint 22.

[0021] The hole 24 and the hole 25 (drawing 9) are formed in the part which turned up the plate as shown in drawing 8 . These holes 24 and 25 are the inlet ports and outlets of cooling water, as shown in drawing 9 . It is made to curve annularly and interpolates in a cooling water jacket 5 so that the edges 21a and 21b of the reinforcement member 21 of a configuration as shown in drawing 8 may be made to counter.

[0022] The quality of the material of steel etc. can be used for the reinforcement member 21, and it can form it with deep drawing using the shuttering of the circular sulcus 7 of a cooling water jacket 5, and the circular sulcus of isomorphism.

[0023] When there is a problem in [the reinforcement member 21] reinforcement, as shown in drawing 10 , a rib 26 may be arranged in a centrum 23. Before this rib 26 carries out deep drawing of the upper clinch part 27 shown by drawing 10 , it is arranged in a centrum 23. Although not illustrated, it is desirable to prepare a hole in a rib 26, to be easy to pass cooling water and to make it become.

[0024]

[Effect of the Invention] In invention of claim 1, it can prevent that the space in the cooling water jacket 5 by the pressure at the time of casting is crushed by interpolating and cast-wrapping the reinforcement member 8 in the air in the insertion member 4.

[0025] Moreover, the following effectiveness can be done so by not using padding, such as sand and a shot ball, into a cooling water jacket 5 like before.

[0026] By using the reinforcement member 8 in the air, after casting, the activity which removes padding can be omitted and the effectiveness rise of an activity can be aimed at.

[0027] Since padding is not used, the cylinder block 100 which padding was not burned at the time of casting and equipped with the cooling water jacket 5 of uniform quality can be manufactured.

[0028] Although the cooling water jacket which is spotted in reinforcement may be done if ** filled up with padding of optimum dose is difficult, and it casts, with the amounts of padding run short, the cooling water jacket 5 of uniform reinforcement can be manufactured by using the reinforcement member 8 instead of padding.

[0029] In invention of claim 2, by using the pipe material which the hole opened as a reinforcement member 8, cooling water can be made to let flow through the inside of a pipe, and a hole, you can make it filled up with cooling water in a cooling water jacket 5, or the cooling water in a cooling water jacket 5 can be discharged.

[0030] The reinforcement member 8 can be formed by low cost by fabricating the plate member (plates 11, 13, and 16) which has a free passage hole (hole 11a) in invention of claim 3 in the shape of a pipe.

[0031] In invention of claim 4, since a plate member (plate 19) can be fabricated spirally and the reinforcement member 8 can be formed, in case the configuration of the reinforcement member 8 is selected, a degree of freedom can be extended (the class of reinforcement member 8 can be increased and the width of face of selection can be expanded).

[0032] By invention of claim 5, since it decided to form the reinforcement member 21 by the single member of a hollow configuration, a degree of freedom can be given to the configuration of the reinforcement member 21 within limits with sheet metal forming possible in which. It becomes that there is less resistance of the flow of cooling water than the case where the reinforcement member 8 in invention of claims 2-4 is used, and it is easy to circulate cooling water within a cooling water jacket 5.

[Translation done.]

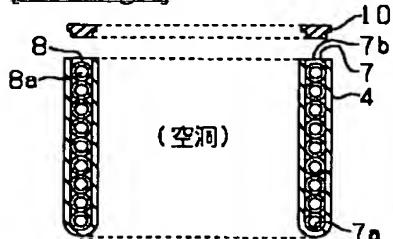
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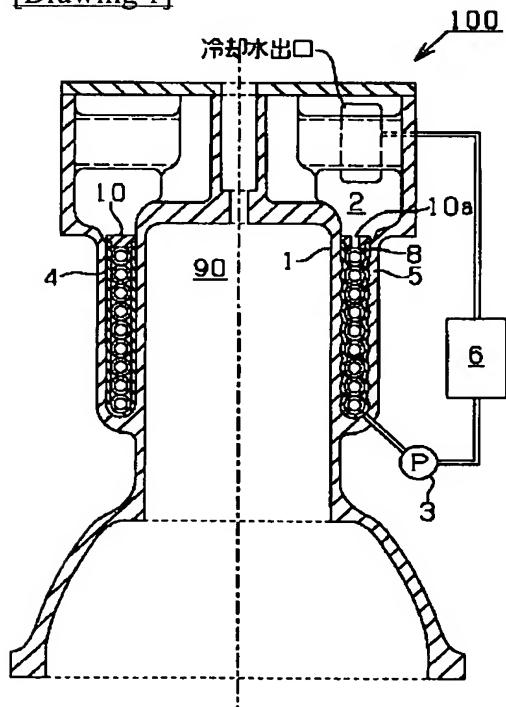
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DRAWINGS

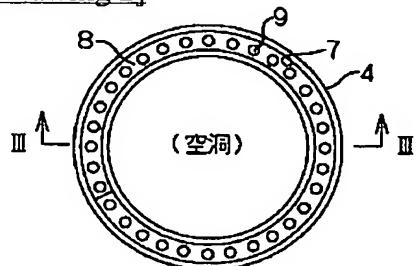
[Drawing 3]



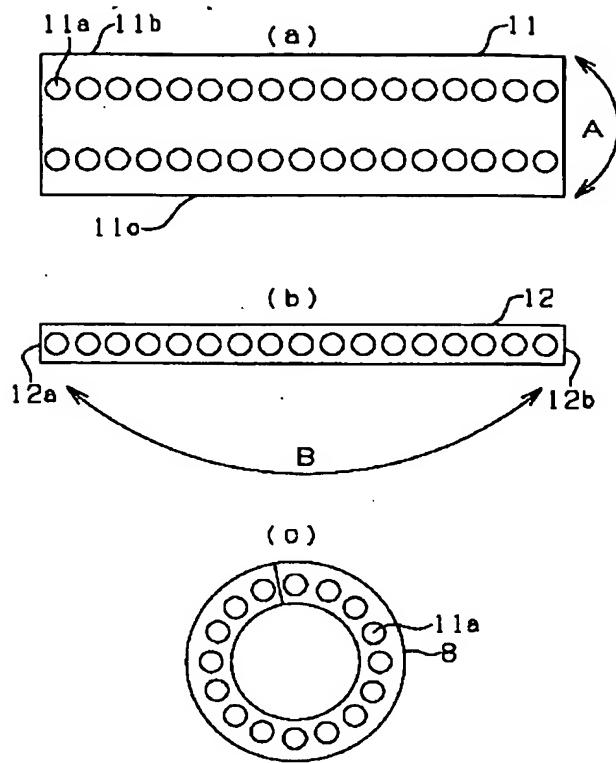
[Drawing 1]



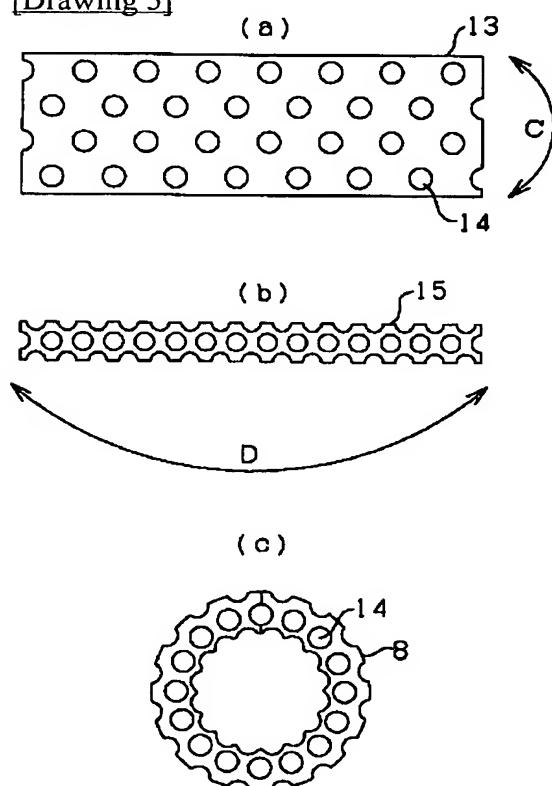
[Drawing 2]



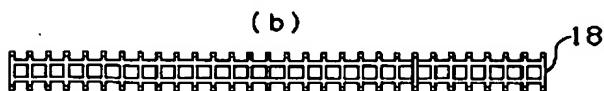
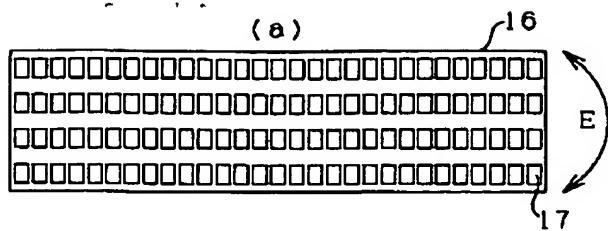
[Drawing 4]



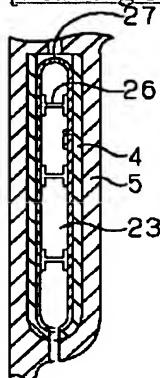
[Drawing 5]



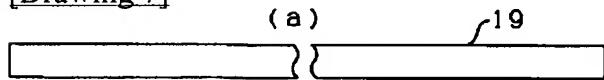
[Drawing 6]



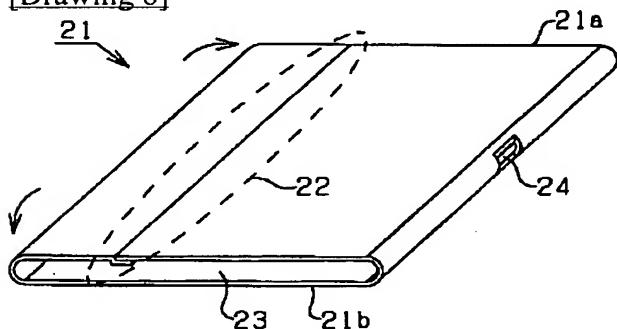
[Drawing 10]



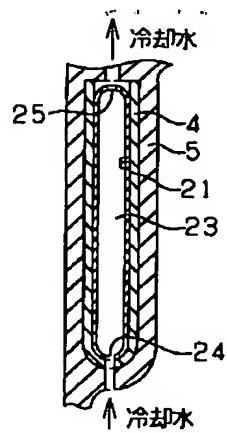
[Drawing 7]



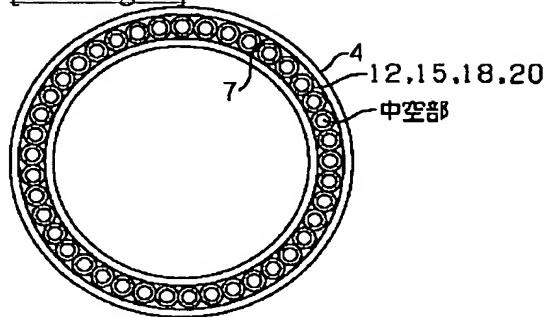
[Drawing 8]



[Drawing 9]



[Drawing 11]



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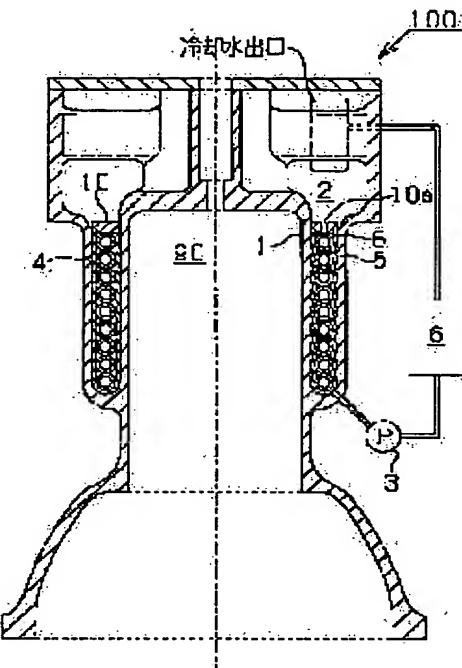
(71)Applicant : YANMAR DIESEL ENGINE CO LTD
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PROBLEM TO BE SOLVED: To provide a cylinder block provided with a cooling water jacket capable of eliminating a process for removing a filler of a cavity part.

SOLUTION: In the cylinder block provided with the cooling water jacket molded by insert casting an insert member, a hollow reinforcing member is inserted into the inserting member to be insert molded. The reinforcing member is formed of a pipe having a communicating hole. A plate member having the communicating hole is molded into a pipe shape, and thereby, the reinforcing member is molded. The plate member is spirally molded, so that the reinforcing member is formed. The reinforcing member is formed with a single member of a hollow shape.



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【0010】

The cooling water jacket 5 of Fig. 1 is cast at an outer periphery of the cylinder block 1 by setting an outer shape of the insert member 4 as a boundary, and as shown in a right side of Fig. 1, some unevenness is formed on the cooling water jacket 5 by pressure generated when casting, however, cooling water can be stored in the cooling water jacket 5 or passed through the cooling water jacket 5, thereby the cylinder block 1 can be cooled.

【0011】

As shown in Fig.2, a plurality of holes 9 may be provided on the reinforcing members 8 so that the respective hollow portions 8a (Fig.3) of the adjacent reinforcing members 8 are communicated each other in order that cooling water supplied from the pump 3 shown in Fig.1 is passed through the hole 9 (Fig.2) of the reinforcing member 8 and the hollow portion 8a (Fig.3) in the insert member 4, then flown in the cylinder head portion 2. The insert member 4 is formed by metal such as aluminum or the like which can be easily processed, and a steel pipe, for example, can be employed as the reinforcing member 8.

【0012】

(Embodiment of the invention according to Claim 3)

An example of a method for manufacturing the reinforcing member 8 will be described. Fig. 4 (a) is a front view of the flat panel 11 which is a raw material of the reinforcing member 8. A plurality of the holes 11a are provided in double lines on the long slender flat panel 11 shown in Fig.4 (a) in a longitudinal direction of the flat panel 11.

【0013】

The flat panel 11 is curved so that end edges 11b and 11c are opposed each other as shown by an arrow A, thereby the pipe 12 is formed as shown in Fig. 4 (b). The pipe 12 is further curved in a circular shape so that end portions 12a and 12b of the pipe 12 are opposed as shown by an arrow B, thereby the circular hollow reinforcing member 8 is formed as shown in Fig. 4 (c).

【0014】

Fig.5 (a) is a front view of the flat panel 13 which is another raw material of the reinforcing member 8. The holes 14 are provided on the flat panel 13 shown in Fig.5 (a) in a zigzag manner. The flat panel 13 is curved as shown by the arrow C as well as the flat panel 12 of Fig. 4 (a), thereby the mesh pipe 15 shown in Fig. 5 (b) is formed. Further, as shown in Fig.5 (c), the mesh pipe 15 is curved in a circular shape as shown by an arrow D, thereby the reinforcing member 8 is formed.

【0015】

Fig.6 (a) is a front view of the flat plate 16 which is other raw material of the reinforcing member 8. The square holes 17 are arranged vertically and horizontally in a regular manner on the flat plate 16 of Fig.6 (a). The flat plate 16 is curved as shown by an arrow E thereby the pipe 18 shown in Fig.6 (b) is formed, then the pipe 18 is curved in a circular shape so as to form the reinforcing member 8 (Not shown).

【0016】

Fig.11 is a plane view showing a state that the pipe 12 shown in Fig.4 (b), Fig.5 (b) and Fig.6 (b), the mesh pipe 15 and

the pipe 18 are inserted in a circular groove 7 of the insert member 4 in a straight line shape. In this case, a trouble to curve the pipe 12 or the like can be saved thereby, a simplified working process can be intended.

【0017】

(Embodiment of the invention according to Claim 4)

Fig.7 (a) is a front view of the flat plate 19 which is raw material to form the reinforcing member 8 by the method different from that of the embodiment according to Claim 3 of the present invention. The flat plate 19 is curved in a spiral shape along a side face of a cylinder to form the spiral member 20 as shown in Fig.7(b). The reinforcing member 8 (not shown) is formed by curving the spiral member 20 in a circular shape. As shown in the above-mentioned Fig.11, a spiral member 20 of Fig.7 (b) may be inserted in the insert member 4 in a straight line shape without being curved.

【0018】

(Embodiment of the invention according to Claim 5)

Fig.8 is a developed perspective view of the reinforcing member 21 according to Claim 5. Fig. 9 is a partial longitudinal sectional view of the cooling water jacket 5 in a state that the reinforcing member 21 is inserted in the cooling water jacket 5.

【0019】

The insert member 4 has a structure same as that of the insert member 4, however, the reinforcing member 21 is different from the reinforcing member 8 of the above-mentioned embodiment in that the reinforcing member 21 has an integral structure from the

bottom portion 7a to the opening portion 7b of the circular groove 7 (Fig.1) of the insert member 4.

【0020】

In order to understand a structure of the circular reinforcing member 21 in which the cooling water jacket 5 shown in Fig. 9 is inserted more easily, the circular reinforcing member 21 is developed in a plane shape in Fig. 8. In Fig.8, the reinforcing member 21 is formed by folding a single flat plate at two portions, superimposing the both end portions, providing steps in a key shape at one end and receiving the other end at the joint portion 22. By jointing the joint portion 22, as shown in Fig. 9, unevenness of the joint portion can be contained in the hollow portion 23 of the reinforcing member 21, thereby the reinforcing member 21 can be easily inserted in the insert member 4.

【0021】

As shown in Fig.8, the hole 24 and the hole 25 (Fig. 9) are provided at a folded portion of the flat plate. As shown in Fig. 9, these holes 24, 25 are an inlet and an outlet for cooling water. Ends 21a and 21b of the reinforcing member 21 having a structure as shown in Fig. 8 are curved so as to be opposed each other and inserted in the cooling water jacket 5.

【0022】

A material such as steel is employed as the reinforcing member 21 and a mold of the circular groove of the cooling water jacket 5 which has a same shape of the circular groove 7 can be formed by deep drawing.

【0023】

If the reinforcing member 21 has a problem concerning its strength, the rib 26 may be arranged in the hollow portion 23 as shown in Fig. 10. The rib 26 is arranged in the hollow portion 23 before applying deep drawing at an upper folded portion 27 shown in Fig. 10. Not shown though, it is preferable that holes are provided on the rib 26 so that cooling water can be passed therethrough.

【0024】

[Effects of the Invention]

In the invention according to Claim 1, the hollow reinforcing member 8 is inserted in the insert member 4 then enclosed therein, thereby a space in the cooling water jacket 5 can be prevented from being crushed by pressure generated when casting.

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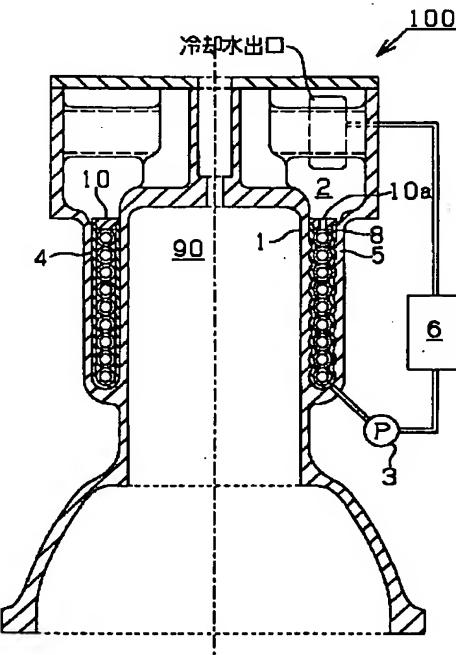
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GA06 HA03 HA07

(54)【発明の名称】冷却水ジャケットを備えたシリンダブロック

(57)【要約】

【課題】空洞部の詰め物を除去する工程を省略することができる冷却水ジャケットを備えたシリンダブロックを提供することである。

【解決手段】インサート部材を鋳包んで成形される冷却水ジャケットを備えたシリンダブロックにおいて、前記インサート部材に中空の補強部材を内挿して鋳包んで成形した。前記補強部材を連通孔を有するパイプで形成する。連通孔を有する板部材をパイプ状に成形することにより補強部材を成形する。板部材を螺旋状に成形することにより補強部材を形成する。補強部材を中空形状の単一部材で形成する。



【特許請求の範囲】

【請求項1】 インサート部材を鋳込んで成形される冷却水ジャケットを備えたシリンダブロックにおいて、前記インサート部材に中空の補強部材を内挿して鋳込んで成形したことを特徴とする冷却水ジャケットを備えたシリンダブロック。

【請求項2】 前記補強部材を連通孔を有するパイプで形成した請求項1に記載の冷却水ジャケットを備えたシリンダブロック。

【請求項3】 連通孔を有する板部材をパイプ状に成形することにより補強部材を成形した請求項1又は請求項2に記載の冷却水ジャケットを備えたシリンダブロック。

【請求項4】 板部材を螺旋状に成形することにより補強部材を形成した請求項1に記載の冷却水ジャケットを備えたシリンダブロック。

【請求項5】 補強部材が中空形状の単一部材からなる請求項1に記載の冷却水ジャケットを備えたシリンダブロック。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、シリンダブロックに冷却水ジャケットを備えた内燃機関に関するものである。

【0002】

【従来の技術】内燃機関のシリンダブロックにおける冷却水の通路（冷却水ジャケット）は、従来からアルミダイキャストの金型で作られている。アルミダイキャストで冷却水ジャケットに相当する型を作り、この型に予め水を入れるための空洞部を作り鋳造する。しかし、それだけでは鋳造圧力で空洞部が潰れてしまうため、対策として空洞部に砂やショット玉を詰め、鋳造後にこれらの詰め物を抜いていた。しかし、空洞部に砂等の詰め物を十分に充填するためには相当な注意が必要であり、充填が不充分になると強度が不均一になる可能性がある。

【0003】

【発明が解決しようとする課題】本発明は上記事情に鑑み、空洞部の詰め物を除去する工程を省略することができる冷却水ジャケットを備えたシリンダブロックを提供することを目的としている。

【0004】

【課題を解決するための手段】上記課題を解決するために、請求項1の発明では、インサート部材を鋳込んで成形される冷却水ジャケットを備えたシリンダブロックにおいて、前記インサート部材に中空の補強部材を内挿して鋳込んで成形した。請求項2の発明では、請求項1の発明において前記補強部材を連通孔を有するパイプで形成した。請求項3の発明では、請求項3の発明において、連通孔を有する板部材をパイプ状に成形することにより補強部材を成形した。請求項4の発明では、請求項

2の発明において、板部材を螺旋状に成形することにより補強部材を形成した。請求項5の発明では、請求項2の発明において、補強部材を中空形状の単一部材で成形した。

【0005】

【発明の実施の形態】図1は、請求項1～請求項5の発明に共通する内燃機関のシリンダブロック100の縦断正面略図である。図1においてシリンダブロック100は、シリンダブロック1の周囲を詳しくは後述するインサート部材4を内挿した冷却水ジャケット5が取り巻いている。

【0006】鋳造後のシリンダブロック100においては、冷却水ジャケット5には下部からポンプ3により冷却水が供給され、冷却水は冷却水ジャケット5内のインサート部材4内又はインサート部材4と冷却水ジャケット5の間を通過中にシリンダブロック1の熱を吸収し、冷却水は冷却水ジャケット5の上部からシリンダヘッド部2を経て冷却水出口からラジエータ6へ送られて冷却され、再度ポンプ3により冷却水ジャケット5内へ供給される。

【0007】（請求項1、2の発明の実施例）図2は、請求項1及び請求項2の発明によるシリンダブロック100（図1）に内挿されているインサート部材4の平面図である。また、図3は、図2のIII-III断面図である。

【0008】図2及び図3に示すように、インサート部材4は周囲に有底の環状溝7を備えており、内部は空洞になっている。インサート部材4の環状溝7内には、環状溝7と同芯でかつ環状溝7に丁度収納可能な太さで剛性を有する中空で環状の補強部材8が環状溝7の底部7a（図3）から開口部7b（図3）に至るまで複数個積み重ねられている。補強部材8は、中空部8a（図3）を有するパイプ材を環状に湾曲させることにより形成している。環状溝7に補強部材8を内挿した後、図3に示す環状の蓋10を環状溝7の開口部7bに嵌合させる。

【0009】図1の一点鎖線より左側は、鋳造後において冷却水ジャケット5内のインサート部材4が押し潰されていないシリンダブロック100の仮想形状を示している。図1の一点鎖線より右側は鋳造後のシリンダブロック100の実際の形状を示している。冷却水ジャケット5は、インサート部材4と共に隣接する補強部材8の狭間の僅んだ部分を若干押し潰しているが、冷却水ジャケット5内には冷却水を通すのに十分な空間が確保されている。インサート部材4の上部に嵌合させた蓋10には、必要箇所に予め必要な量の水を流すための孔10aが複数箇所（図1にはそのうちの一つのみを表示）に設けられており、その孔10aを通して冷却水がシリンダヘッド部2へ流れる。

【0010】図1の冷却水ジャケット5は、シリンダブロック1の外周において上記のインサート部材4の外形

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を境界として鋳型成形され、鋳造時の圧力により冷却水ジャケット5は、図1の右側に示すように若干の凹凸ができるが、冷却水ジャケット5内には冷却水を貯める、または通過させることができ、シリンダプロック1を冷却することができる。

【0011】ここで図2に示すように補強部材8に複数の孔9を設け、隣接する補強部材8の各々の中空部8a(図3)を連通させ、図1のポンプ3により供給された冷却水がインサート部材4内の補強部材8の孔9(図2)及び中空部8a(図3)内を通過してシリンダヘッド部2へ流れるようになることができる。インサート部材4は、例えばアルミニウム等の加工容易な金属で形成し、補強部材8は、例えばスチール製のパイプを採用することができる。

【0012】(請求項3の発明の実施例) 補強部材8の製造方法の一例を説明する。図4(a)は、補強部材8の原材料である平板11の正面図である。図4(a)に示す細長い平板11には、複数の孔11aが平板11の長手方向に2列に設けてある。

【0013】この平板11を矢印Aで示すように端辺11bと11cが対向するように湾曲させ、図4(b)に示すようなパイプ12を形成する。パイプ12をさらに矢印Bで示すようにパイプ12の端部12aと12bが対向するように環状に湾曲させ、図4(c)に示すような環状で中空の補強部材8を形成する。

【0014】図5(a)は、補強部材8の別の原材料である平板13の正面図である。図5(a)に示す平板13には孔14が千鳥配置されている。この平板13を図4(a)の平板12と同様に矢印Cで示すように湾曲させて図5(b)に示すメッシュパイプ15を形成する。さらに図5(c)に示すように、メッシュパイプ15を矢印Dで示すように環状に湾曲させ、補強部材8を形成する。

【0015】図6(a)は、補強部材8のさらに別の原材料である平板16の正面図である。図6(a)の平板16には四角形の孔17が縦横に規則正しく配置されている。この平板16を矢印Eで示すように湾曲させて図6(b)に示すパイプ18を形成し、その後、環状に湾曲させて補強部材8(図示せず)を形成する。

【0016】図11は、インサート部材4の環状溝7に図4(b)、図5(b)及び図6(b)で示すパイプ12、メッシュパイプ15及びパイプ18を直線形状のまま挿入した状態を示す平面図である。この場合、パイプ12等を湾曲させる手間が省け、作業工程の簡略化を図ることができる。

【0017】(請求項4の発明の実施例) 図7(a)は、上記請求項3の発明の実施例とは別な方法で補強部材8を形成するための原材料である平板19の正面図である。平板19を円柱の側面に沿って螺旋状に湾曲させ、図7(b)に示すような螺旋部材20を形成する。

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この螺旋部材20を環状に湾曲させることにより、補強部材8(図示しない)を形成する。上述した図11に示すように、図7(b)の螺旋状部材20を湾曲させずに直線状のままの状態でインサート部材4内に挿入してもよい。

【0018】(請求項5の発明の実施例) 図8は、請求項5の発明による補強部材21の展開斜視図である。図9は、冷却水ジャケット5内に補強部材21が内挿された状態の冷却水ジャケット5の一部縦断面図である。

【0019】インサート部材4は上述したインサート部材4と同じ構造であるが、補強部材21はインサート部材4の環状溝7(図1)の底部7aから開口部7bに至るまで一体構造になっている点で上述の各実施例における補強部材8と異なる。

【0020】図9における冷却水ジャケット5に内挿した環状の補強部材21の構造を理解し易くするため、図8において環状の補強部材21を平面状に開いて示した。図8において補強部材21は、1枚の平板を2箇所で折り曲げ、両端を重ねて接合部22において一方を鍵状に段を設けて他方の端部を受けている。接合部22のような接合の仕方をすることにより、図9に示すように接合部の凹凸を補強部材21の中空部23内に収めることができ、補強部材21をインサート部材4内に挿し易くなる。

【0021】図8に示すように平板を折り返した部分には孔24及び孔25(図9)が設けてある。この孔24、25は、図9に示すように冷却水の入口及び出口である。図8に示すような構成の補強部材21の端部21a及び21bを対向させるように環状に湾曲させて冷却水ジャケット5に内挿する。

【0022】補強部材21は、例えばスチール等の材質を採用し、冷却水ジャケット5の環状溝7と同形の環状溝の型枠を用いて深絞りにより形成することができる。

【0023】補強部材21が強度的に問題がある場合には、図10に示すように中空部23内にリブ26を配置してもよい。このリブ26は、図10で示す上方の折り返し部分27を深絞り加工する前に中空部23内に配置する。図示していないが、リブ26に孔を設け、冷却水が通過し易くなるようにするのが好ましい。

【0024】
【発明の効果】請求項1の発明では、インサート部材4に中空の補強部材8を内挿して鉄包むことにより、鋳造時の圧力による冷却水ジャケット5内の空間が押し潰されることを防止することができる。

【0025】また、従来のように冷却水ジャケット5内に砂やショット玉等の詰め物を用いないことにより、以下の効果を奏することができる。

【0026】中空の補強部材8を用いることにより、鋳造後に詰め物を除去する作業を省略することができ、作業の効率アップを図ることができる。

【0027】詰め物を用いないため鋳造時に詰め物が焼付くことがなく、一様な品質の冷却水ジャケット5を備えたシリンダブロック100を製造することができる。

【0028】適量の詰め物を充填するは困難であり、詰め物の量が不足したまま鋳造すると、強度的に斑のある冷却水ジャケットができ上がる可能性があるが、詰め物の代わりに補強部材8を用いることにより、均一な強度の冷却水ジャケット5を製造することができる。

【0029】請求項2の発明では、孔の開いたパイプ材を補強部材8として使用することにより、パイプ内及び孔を介して冷却水を通水させることができ、冷却水ジャケット5内に冷却水を充填させたり冷却水ジャケット5内の冷却水を排出することができる。

【0030】請求項3の発明では、連通孔(孔11a)を有する板部材(平板11, 13, 16)をパイプ状に形成することにより、低コストで補強部材8を形成することができる。

【0031】請求項4の発明では、板部材(平板19)を螺旋状に成形して補強部材8を形成することができる。この、補強部材8の形状を選定する際に自由度を広げることができる(補強部材8の種類を増やし、選択の幅を広げることができる)。

【0032】請求項5の発明では、中空形状の単一部材で補強部材21を形成することにしたので、板金成形が可能な範囲内で補強部材21の形状に自由度を持たせることができる。請求項2~4の発明における補強部材8を用いた場合よりも冷却水の流れの抵抗が少なく、冷却水ジャケット5内で冷却水を循環させ易くなる。

【図面の簡単な説明】

【図1】内燃機関のシリンダブロック100の縦断正面図である。

【図2】請求項1及び請求項2の発明によるシリンダブロックに内挿されているインサート部材の平面図である。

【図3】図2のIII-III断面図である。

【図4】(a)は、補強部材の原材料である平板の正面図である。(b)は、(a)の平板を元に形成したパイプの正面図である。(c)は、(b)のパイプを環状に湾曲させて形成した補強部材の平面図である。

【図5】(a)は、補強部材の原材料である平板の正

*面図である。(b)は、(a)の平板を元に形成したメッシュパイプの正面図である。(c)は、(b)のメッシュパイプを環状に湾曲させて形成した補強部材の平面図である。

【図6】(a)は、補強部材の原材料である平板の正面図である。(b)は、(a)の平板を元に形成したパイプの正面図である。

【図7】(a)は、補強部材の原材料であるひも状の平板の正面図である。(b)は、(a)の平板を元に形成した螺旋状部材の正面図である。

【図8】請求項5の発明によるシリンダブロックの形成に用いられる冷却水ジャケットに内挿する補強部材の展開斜視図である。

【図9】請求項5の発明によるシリンダブロックの冷却水ジャケット部分の断面略図である。

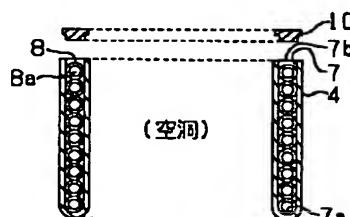
【図10】図9において、補強部材にリブを追加した状態を示す断面略図である。

【図11】インサート部材に直線状の補強部材を挿入した状態を示す平面図である。

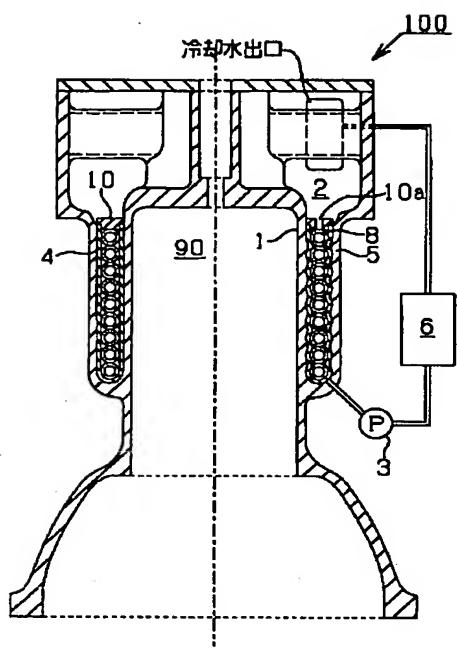
【符号の説明】

1	シリンダヘッド
2	貯水部
3	ポンプ
4	インサート部材
5	冷却水ジャケット
6	ラジエータ
7	環状溝
8	補強部材
9, 14	孔
10	蓋
11, 13, 16	平板
12	パイプ
14	孔
15	メッシュパイプ
17	孔
23	中空部
26	リブ
24, 25	孔
90	燃焼室
100	シリンダブロック

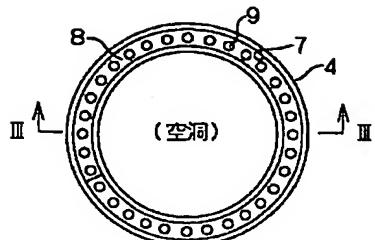
【図3】



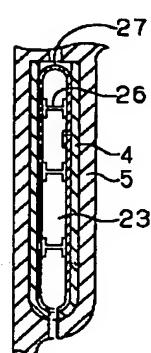
【図1】



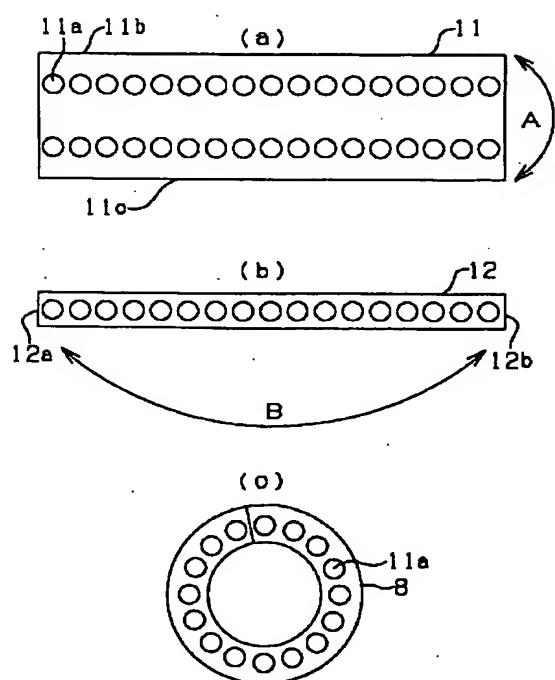
【図2】



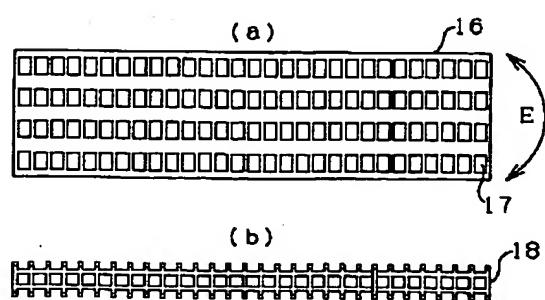
【図10】



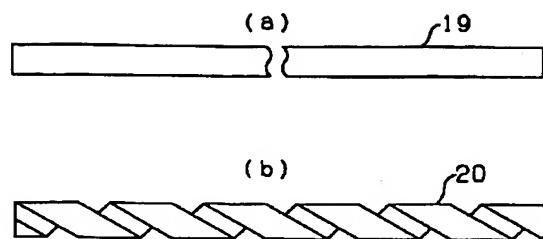
【図4】



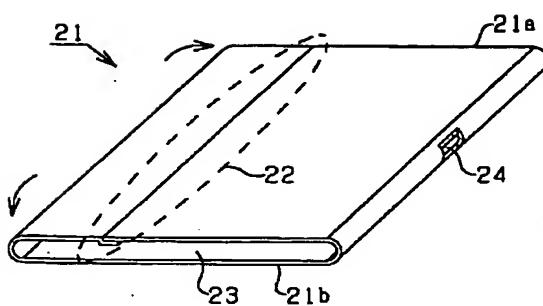
【図6】



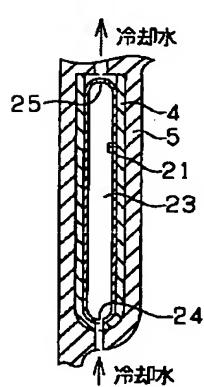
【図7】



【図8】



【図9】



【図11】

